Name:________________________________ Date:________________

Polynomial Operations SOLUTION (version 142)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -8x^5 - 3x^3 - 2x^2 + 6x + 7$$

$$q(x) = -6x^5 + 8x^4 - 5x^3 - 9x^2 + 1$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (-8)x^5 + (0)x^4 + (-3)x^3 + (-2)x^2 + (6)x^1 + (7)x^0 \\
q(x) &= (-6)x^5 + (8)x^4 + (-5)x^3 + (-9)x^2 + (0)x^1 + (1)x^0 \\
q(x) - p(x) &= (2)x^5 + (8)x^4 + (-2)x^3 + (-7)x^2 + (-6)x^1 + (-6)x^0 \\
q(x) - p(x) &= 2x^5 + 8x^4 - 2x^3 - 7x^2 - 6x - 6
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -8x^2 + 3x - 5$$

$$b(x) = 7x - 5$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-8x^2$	$3x$	-5
$7x$	$-56x^3$	$21x^2$	$-35x$
-5	$40x^2$	$-15x$	25

$$a(x) \cdot b(x) = -56x^3 + 21x^2 + 40x^2 - 35x - 15x + 25$$

Combine like terms.

$$a(x) \cdot b(x) = -56x^3 + 61x^2 - 50x + 25$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 10x^2 - 7x - 29 \\ g(x) &= x + 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	2	10	-7	-29
-5		-10	0	35
	2	0	-7	6

So,

$$\frac{f(x)}{g(x)} = 2x^2 - 7 + \frac{6}{x+5}$$

In other words, $h(x) = 2x^2 - 7$ and the remainder is $R = 6$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 10x^2 - 7x - 29$. Evaluate $f(-5)$.

You could do this the hard way.

$$\begin{aligned} f(-5) &= (2)\cdot(-5)^3 \ + \ (10)\cdot(-5)^2 \ + \ (-7)\cdot(-5) \ + \ (-29) \\ &= (2)\cdot(-125) \ + \ (10)\cdot(25) \ + \ (-7)\cdot(-5) \ + \ (-29) \\ &= (-250) \ + \ (250) \ + \ (35) \ + \ (-29) \\ &= 6 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-5)$ equals the remainder when $f(x)$ is divided by $x+5$. Thus, $f(-5) = 6$.